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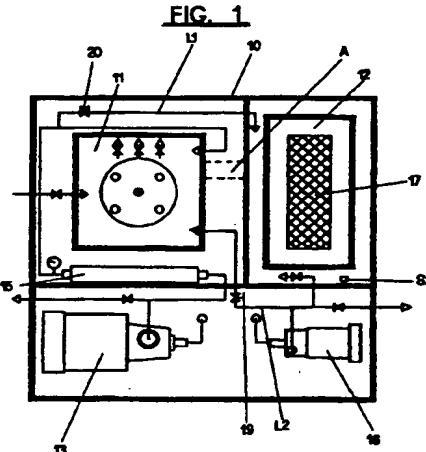
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(54) **Process for controlling the pH value of liquids used in industrial processes and system for carrying out the process**

(57) The process for continuously controlling the pH value of an industrial process liquid consists in removing from said liquid the impurities contained therein and controlling its pH value, if necessary adding thereto an aqueous solution having an acid or basic character, feeding the purified process liquid having the desired acid or basic pH value to the industrial process, maintaining the character of the aqueous solution constantly acid or basic by means of ion exchange resins and repeating the above steps. The system comprises a first tank (11) with a pH-meter (18) for the process liquid to be treated, a second tank (12) for said aqueous solution, pumps or the like (13, 16) for recirculating the process liquid in said first tank (11) and supplying it to the industrial process and for recirculating said aqueous solution in said second tank (12), and valve means (20) for admitting in said first tank (11) said pH adjusting liquid to be added to the process liquid to be treated.



**Description**

The present invention relates to industrial processes requiring a continuous control of the pH value of process liquids and, more particularly, an innovative process for controlling the pH value of such process liquids and a system for carrying out such process.

The process and the system of the present invention are particularly suited for use in the graphic arts and printing industry where control of the pH value of liquids used in the pre-printing and offset printing processes, f.i. aqueous solutions, is required.

In industrial processes of this kind, the problem relating to the chemical treatment of liquids employed in many printing processes before being reused is most important.

Generally, before the reuse of liquids of said industrial processes, their pH value must be restored to the nominal value. According to known processes, this is achieved by adding chemical additives having acid or basic pH values to the process liquids depending on the required pH value. These additives are mixed together with the process liquid and therefore they must be added every time a change of the pH value of the process liquid from its nominal value occurs. Therefore, there is a considerable consumption of chemical additives which, besides being expensive, have the disadvantages of considerably increasing the conductivity of the process liquids and of producing foams and precipitates that negatively affect the printing process. As a matter of fact, the printing quality so obtained is rather poor. Another drawback resulting from the use of chemical additives is related to the environmentally dangerous and harmful fumes produced in the printing rooms.

Therefore, one object of the present invention is to provide an improved process for continuously controlling the pH value of industrial process liquids which does not rely upon the addition of chemical additives.

Another object of the present invention is to provide a system for continuously controlling the pH value of industrial process liquids which is compact in size and less expensive than conventional systems requiring the addition of chemical additives.

More particularly, the process according to the invention for continuously controlling the pH value of an industrial process liquid, is characterized in that it comprises the steps of:

- a) removing from the process liquid coming from an industrial process the impurities contained therein and controlling its pH value;
- b) if the pH value of the purified process liquid differs from its nominal value, adding thereto an aqueous solution having an acid or basic character, depending on the employed process liquid, until its pH value reaches its nominal value;
- c) feeding the purified process liquid having the desired acid or basic pH value to the intended industrial process;

5 d) maintaining the character of the aqueous solution to be added to the process liquid constantly acid or basic by means of ion exchange resins; and e) repeating the steps a), b), c) and d).

According to a feature of the present invention, the removing step may be carried out by mechanical, physical or chemical-physical means.

10 The system for carrying out the process according to the present invention is characterized in that it comprises:

- a first tank provided with a pH-meter for the process liquid to be treated,
- 15 - a second tank for a pH adjusting liquid,
- recirculating means for recirculating the process liquid to be treated in said first tank and supplying it to the intended industrial process and for recirculating said pH adjusting liquid in said second tank, and
- 20 - valve means for admitting in said first tank said pH adjusting liquid to be added to the process liquid to be treated.

25 According to a feature of the present invention, in the first tank mechanical, physical or chemical-physical means are provided for removing the impurities contained in the process liquid to be treated.

According to a feature of the present invention, said pH adjusting liquid is an acid or basic aqueous solution.

30 35 The process according to the present invention will be more apparent from the description of a preferred embodiment of a system for controlling the pH value of process liquids shown in the accompanying drawings, wherein:

Fig. 1 is a plan view of the system for carrying out the process of the invention;

Fig. 2 is a sectional view along line II-II of Fig. 1;

Fig. 3 is a sectional view along line III-III of Fig. 1.

**pH CONTROL PROCESS**

40 45 The pH control process according to the invention will be now described in more detail as follows.

Firstly, the liquid from an industrial process and having an acid or basic character, depending on the kind of process, undergoes a separating operation in order to remove therefrom impurities resulting from its use in different industrial processes.

50 55 Possibly, during this step the process liquid may undergo a magnetic treatment aimed at reducing its surface tension. This is achieved by letting the process liquid flow through a steady magnetic field having a suitable strength generated by permanent magnets.

Alternatively, a stream of gas, preferably air, may be blown in the process liquid in order to reduce its surface tension.

Then, the pH value of the purified process liquid is

controlled and if the pH value corresponds to the nominal value the purified process liquid is fed to the intended use in the industrial process.

If instead the pH value of the process liquid differs from the nominal value, to the purified process liquid is added an acid or basic aqueous solution until the pH value of the purified process liquid reaches the desired value.

Afterwards, the purified process liquid having its nominal pH value obtained with the addition of the acid or basic aqueous solution, is supplied to the intended use in the industrial process.

The steps of the process are cyclically repeated, while the character of the aqueous solution to be added to the purified process liquid is constantly maintained acid or basic by means of ion exchange resins.

#### pH CONTROL SYSTEM

Referring to Figs. 1, 2 and 3, there is shown a preferred embodiment of systems for carrying out the process of the invention. This system is enclosed in a box 10 and comprises a first tank 11 intended to contain the process liquid coming from an industrial process and requiring a pH adjusting treatment and a second tank 12 intended to contain a pH adjusting liquid, in this case an acid or basic aqueous solution depending on the need.

The process liquid to be treated in the tank 11 undergoes a separating operation during which the impurities contained therein are removed by means of a separator 14 placed at the bottom of the tank 11. Said separator may be a filter if a mechanical separation of solid impurities is required. In this case, a pump 13 recirculates the process liquid to be treated in the tank 11 through the filter 14. The separator may also be of the physical or chemical-physical kind if the impurities contained in the process liquid to be treated are non-solid. The process liquid to be treated coming from the separator flows through a magnetic device 15 intended to reduce the surface tension of said process liquid by means of a magnetic field generated by permanent magnets.

Alternatively, a gas, preferably air stream blower (not shown), may be used for reducing the surface tension of the process liquid.

The pH adjusting liquid, i.e. the acid or basic aqueous solution in the tank 12 is recirculated by means of a pump 16 and this aqueous solution is maintained acid or basic by continuously flowing it through an ion exchanger 17 provided at the bottom of tank 12.

A pH-meter immersed into the tank 11 permits the pH value of the process liquid to be treated to be easily measured. Generally, said process liquid to be treated requires an adjustment of the pH value for its reuse in the intended industrial process. Therefore, if the pH-meter measures a pH value different from that required for the intended industrial process, a solenoid valve 19 in a line L1 branched from the circuit in which the acid or

basic aqueous solution is recirculating is opened. The aqueous solution thus supplied to the tank 11 is added to the process liquid contained therein. When the pH-meter 18 measures a pH value of the process liquid contained in the tank 11 corresponding to the value required for the intended industrial process, the solenoid valve 19 is closed and the purified process liquid with the desired pH value is supplied to the industrial process for its reuse therein.

If the level of the acid or basic aqueous solution during the addition thereof to the process liquid contained in the tank 11 lowers below the value H1, a level sensor S1 controls the opening of a solenoid valve 20 in the line L2 branched from the recirculating circuit of the purified process liquid contained in tank 11. This permits said purified process liquid to be supplied to the tank 12 containing the acid or basic aqueous solution until the latter reaches level H2 and when this occurs a sensor S2 causes the solenoid valve 20 to be closed.

Alternatively, for restoring the level of the acid or basic aqueous solution in the tank 12, in a side wall of the tank 11 an overflow A is provided through which the process liquid contained in tank 11 can flow into the tank 12.

An acoustic and visual signaling system indicates when the charge of the ion exchange resins is exhausted. The exhausted ion exchange resins can be regenerated by means of a well known separate equipment that can be connected to the ion exchanger or said ion exchange resins can be replaced with fresh ion exchange resins, while the exhausted ion exchange resins are removed and delivered to a separate regeneration station.

As already said the pH control process and system according to the invention is particularly adapted to be applied in the graphic arts and in the printing industries. In this case the process liquid to be treated is mainly a process water and the pH adjusting liquid is an acid aqueous solution. The ion exchange resins are of cationic type.

As can be understood from the above description, the pH control system according to the invention does not longer require the addition of chemical additives as for example isopropyl alcohol in the case of printing processes. Therefore, the pH control system results less expensive than other known systems and does not produce undesired effects such as the increase of the conductivity of the process liquid or the formation of foams or precipitates.

Although the invention has been disclosed and illustrated in connection with a preferred embodiment only, it is understood that all changes and modifications within the reach of those skilled in the art may be made thereto without departing from the scope of the claims. Particularly, the two tanks can be contiguous and can communicate by means of an overflow.

## Claims

1. Process for continuously controlling the pH value of an industrial process liquid, characterized in that it comprises the steps of:
- removing from the process liquid coming from an industrial process the impurities contained therein and controlling its pH value;
  - if the pH value of the purified process liquid differs from its nominal value, adding thereto an aqueous solution having an acid or basic character, depending on the employed process liquid, until its pH value reaches its nominal value;
  - feeding the purified process liquid having the desired acid or basic pH value to the intended industrial process;
  - maintaining the character of the aqueous solution to be added to the process liquid constantly acid or basic by means of ion exchange resins; and
  - repeating the steps a), b), c) and d).
2. Process according to claim 1, characterized in that said removing step is carried out by mechanical, physical or chemical-physical means.
3. Process according to claim 1, characterized in that said process liquid flows through a magnetic field in order to reduce the surface tension thereof.
4. Process according to claim 1, characterized in that a stream of gas is blown into said process liquid in order to reduce the surface tension thereof.
5. System for carrying out the process according to claims 1 to 4, characterized in that it comprises:
- a first tank (11) provided with a pH-meter (18) for the process liquid to be treated,
  - a second tank (12) for a pH adjusting liquid,
  - recirculating means (13,16) for recirculating the process liquid to be treated in said first tank (11) and supplying it to the intended industrial process and for recirculating said pH adjusting liquid in said second tank (12), and
  - valve means (20) for admitting in said first tank (11) said pH adjusting liquid to be added to the process liquid to be treated.
6. System according to claim 5, characterized in that in said first tank (11) mechanical, physical or chemical-physical means (14) are provided for removing the impurities contained in said process liquid to be treated.
7. System according to claim 5, characterized in that said pH adjusting liquid is an acid or basic aque-
- ous solution.
8. System according to claim 5, characterized in that said valve means (20) are interlocked to said pH-meter (18) so as to cause the admission of the pH adjusting liquid to be made only when the pH-value of the process liquid is different from its nominal value.
9. System according to claims 5 to 8, characterized in that said second tank (12) includes ion exchangers (17) for maintaining the character of the pH adjusting liquid to be admitted to the process liquid always acid or basic.
10. System according to claims 5 to 9, characterized in that it further comprises means (15) for reducing the surface tension of the process liquid.
11. System according to claim 10, characterized in that said means (15) for reducing the surface tension of the process liquid are of magnetic type.
12. System according to claim 10, characterized in that said means (15) for reducing the surface tension of the process liquid are gas blowers.
13. System according to claims 5 to 9, characterized in that said recirculating means (13,16) are pumps or ejectors.

FIG. 1

